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Abstract

The thrust of this thesis is the development of two different kinds of feed-forward control strategy using the semi-active device MR damper to monitor MR damper supply current/voltage. The study develops a feed-forward control strategy both for linear and nonlinear base isolated buildings. This is achieved by the implementation of an appropriate control force algorithm which must respond to the earthquake induced ground acceleration in real time. This work is focused in the development of an appropriate control force algorithm which responds to ground acceleration in real time. In this work, both analytically and numerically it has been demonstrated that by the implementation of above mentioned control force algorithm the base drift response as well as the superstructure inter-story drift can be reduced significantly compared to the response without control. Also the absolute floor acceleration can be reduced with this control force implementation. The thesis is divided into six chapters as described below.

- Chapter 1 provides an overall background of the studies on hybrid base isolated buildings and motivation for the present work.
- Chapter 2 gives a critical appraisal of the present state of the art in the field of the structural vibration control and intelligent control systems. Based on the critical appraisal of the present state-of –the-art, problems that have not been addressed but having significant importance, have been identified that form the motivation for present study.
- Chapter 3 describes details of the mathematical modeling of the linear base-isolated buildings and how the linearity property can be exploited to develop a feed-forward control strategy is explained. Furthermore, a semi-active device (MR damper) dynamics has been discussed in the context of the implementation of the said control algorithm and the simulation results using the same has been reported in terms of performance evaluation criteria provided for the ASCE benchmark problem (Narasimhan et al. (2006)[252]).
- Chapter 4 describes feed-forward algorithm for nonlinear base-isolated buildings which ensures reduction of responses (both maximum inter-storey drifts and maximum floor accelerations) by a definite percentage of the corresponding response of the uncontrolled structure.
- Chapter 5 develop a feed-forward control strategy which can guarantee reduction of maximum base drift for both linear as well as nonlinear base-isolated buildings by a definite percentage of the corresponding response of uncontrolled structure irrespective of the nature of ground motions. However, this control strategy is not as good as the control strategy proposed in the chapter 3 and chapter 4 as far as reduction of superstructure responses are concerned. This is evident from the simulation results which has been reported in comparison with some of the results reported in the literature in terms of performance evaluation criteria as provided for ASCE benchmark problem (Narasimhan et al. (2006)[252]).
- A summary of contributions made in this thesis, together with a few suggestions for future research, are presented in Chapter 6. Finally the references are listed